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Change in refractive status of the patients undergoing phacoemulsification surgery

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ABSTRACT

This study was carried out with the objective of finding refractive status of patients undergoing phacoemulsification surgery for cataract extraction. Success of cataract surgery can be quantified with the improvement in visual acuity with least amount of refractive error. Prospective study of 44 patients was done pre operatively and with subsequent follow up in the first, third and eighth week post operatively. Pre and post operative evaluation was carried out in terms of visual acuity, refractive error and corneal curvature. Among patients undergoing surgery, 91.0% achieved visual acuity of 6/9 or better at eighth week follow up 73.3% of patients had astigmatism of 1.25 dioptric cylinder or less. Keratometry readings showed insignificant variability in the preoperative and postoperative period ($p>0.05$). This confirms that phacoemulsification surgery does not change the corneal curvature significantly and thereby induces less amount of astigmatism.

Keywords: Phacoemulsification surgery, refractive status, astigmatism, corneal curvature.

INTRODUCTION

Cataract is the most common cause of blindness worldwide[1]- similarly in Nepal, cataract accounts for 66.8% of blindness.[2] According to research, in the developing world one blind person takes two people out of the work force if the blind requires care of an able adult.[3] So in the developing country like Nepal economical consequence of cataract is two fold. Complication of cataract surgery has been one of the leading causes of visual impairment.

Phacoemulsification is a safer and reliable surgery for restoration of visual acuity in patients with cataract, and is superior to extracapsular cataract extraction (ECCE).[4] The basic advantage of this method over the conventional ECCE is that it involves a very small incision (3.00mm compared to 8.00-10.00 mm of ECCE), this small incision results in faster wound healing without need of wound suturing. Studies have shown that Phacoemulsification procedure produces less astigmatism and more rapid visual rehabilitation along with better quality of life.[5-7] If this is so, this procedure can be very rewarding for Nepalese population as well to provide best post operative vision without the glasses, where glasses are rarely worn on regular basis and rarely changed if broken.

PATIENTS AND METHODS

A prospective study of 44 patients undergoing phacoemulsification surgery for cataract extraction was conducted. Cases which had preoperative conditions that could influence the post operative refractive status, such as patients who had trabeculectomy, were excluded from the study as well as those planned for the combined surgical procedure. Among these patients 19 underwent clear corneal incision while 25 scleral tunnel incision.

All patients undergoing surgery were evaluated pre operatively. Visual acuity was recorded with the help of internally illuminated standard Snellen's Chart. Biomicroscopy and Direct Ophthalmoscopy was done to find out the type of cataract and to rule out other ocular pathologies. Streak Retinoscopy was performed in a dark room and subjective refraction done to find out the best-corrected visual acuity. Keratometry was performed for every eye, readings were taken in two principal meridians; three times and the mean of the readings was taken and recorded.

Same evaluations were carried out post operatively in the first, third and eighth week. The findings were recorded and data evaluated to come up with final results.

RESULTS

Among the 44 patients that underwent surgery 27 patients had pre operative vision of less than 6/60, 13 had 6/24-6/60 whereas, 4 had vision of 6/18 or better. Among the total patients that underwent phacoemulsification surgery, 19 had clear corneal incisions and 25 had scleral incision.

Most of the patients had astigmatism in first week follow up irrespective of type of incision. The mean astigmatism for

Table-1: Showing astigmatism in the first week follow up

Amount of Astigmatism (Diopters)	Corneal	Scleral
0.00-0.50	4	6
0.75-1.25	5	11
1.50-2.00	8	5
2.25-3.00	1	1
>3.00	1	2
Total	19	25

patients with clear corneal incision was 1.43D (SD 0.89) and 1.24 D (SD 1.24) for those with scleral incision with majority having astigmatism of 0.75 to 2.00 dioptres (Table-1).

The amount of astigmatism after surgery in post operative period of both third week and eighth week with corneal incision showed mean astigmatism of 0.97D (SD 1.02). Majority of the patients (68.7%) had astigmatism of less than 1.25 D. On the other hand 78.6% of patients receiving scleral incision had astigmatism of less than 1.25 D with mean astigmatism being 0.91 D (SD 0.58).

Patients undergoing phacoemulsification surgery with clear corneal incision showed decay in astigmatism resulting in 0.00-0.50 D of astigmatism in majority of cases by third week onwards (Fig. 1). Patients who had undergone phacoemulsification surgery with scleral incision showed astigmatism of 0.75-1.25 D in majority of cases even after the third week and later (Fig. 2).

Mean preoperative keratometric reading was 7.77mm and 7.64 in vertical meridian and horizontal in those with corneal incisions and 7.62mm in both vertical and horizontal meridians in those receiving scleral incision. Keratometry reading showed changes over the post operative period with mean radius of curvature for the corneal incision group being 7.74mm and 7.72mm in the vertical and horizontal meridian and 7.63mm and 7.59mm for scleral group respectively in post operative period of third week and later (Table-2).

Table-2: Mean keratometric readings

Keratometry Readings	Corneal Incision		Scleral Incision	
	Vertical Mean (SD)	Horizontal Mean (SD)	Vertical Mean (SD)	Horizontal Mean (SD)
Pre-Op	7.77 (0.35)	7.643 (0.13)	7.62 (0.29)	7.622 (0.23)
First Week	7.70 (0.30)	7.71 (0.22)	7.59 (0.31)	7.633 (0.27)
Third Week and later	7.74 (0.25)	7.72 (0.20)	7.63 (0.27)	7.59 (0.22)

* P> 0.05

These changes in the keratometric readings were insignificant in both scleral and corneal groups and in both the meridians, vertical as well as horizontal with p value >0.05, using paired t-sample test.

Among these patients few were astigmatically neutral (6 in cases of corneal and 2 in cases of scleral) and among those with astigmatism, more than 60.0% had against the rule astigmatism while equal number of patients had with the rule and oblique astigmatism (Fig. 3).

Among the forty-four patients that underwent the phacoemulsification surgery, majority recovered the best corrected visual acuity of 6/9 or better whereas two patients had acuity ranging from 6/18 to 6/24. One patient with Amblyopia had visual acuity of 6/60 (Table-3).

DISCUSSIONS

The evaluation of pre operative visual acuity (VA) showed that majority of patients turned out for surgery when the available vision was not sufficient for their daily activities with 61.4% (n=27) seeking surgery with acuity of less than 6/60. Population based surveys in Nepal, India and China has shown that of all the patients operated on for cataract, 21.0-53.0% had a presenting visual acuity of less than 6/60.[8] The mean astigmatism in patients with corneal incision in first week was 1.43D

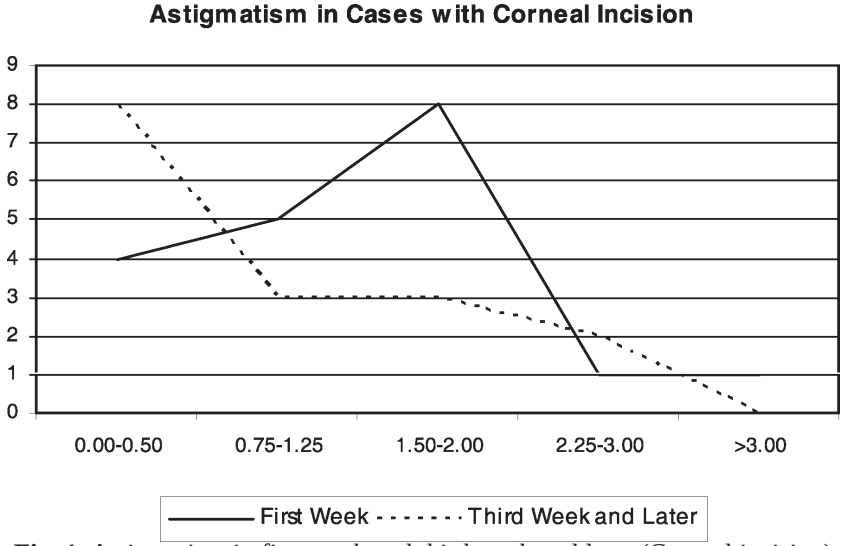

Fig. 1. Astigmatism in first week and third week and later (Corneal incision)

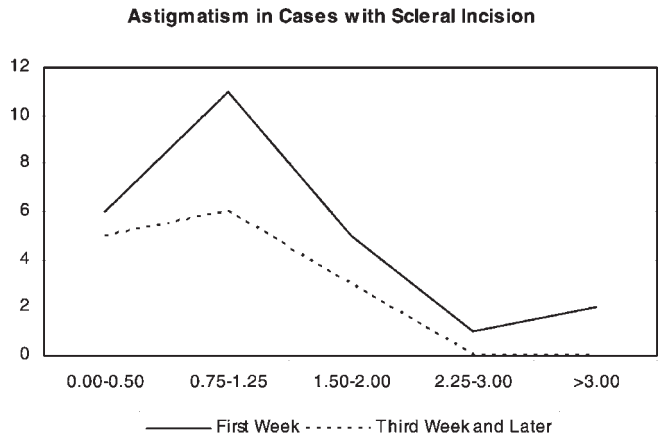

Fig. 2. Astigmatism in first week and third week and later (Scleral incision)

(+/-0.89) and 1.24 D (+/-1.24) in those with scleral incision. In subsequent follow up, little change in the axis of astigmatism was noted. The amount of astigmatism however showed gradual change over a period of time in most of the cases. At the end of third week and eighth week, corneal incision had mean astigmatism of 0.97D (+/- 1.02) and in scleral incision group the mean astigmatism was 0.91 D (+/- 0.58).

In a study done by R. Sapkota in patients undergoing the surgery with the conventional ECCE reported upto 1.00 D of cylinder in 58.3% of patients, 25.0% with more than 2.00D of cylinder and 16.7% with more than 5.00D of cylinder.[9] While in our study only 18.2% of those undergoing phacoemulsification surgery reported astigmatism of more than 1.50 D at the end of eight week and none had astigmatism of more than 3.00 D. Dam-Johansen M, Olsen T *et al* evaluated the refractive results after phacoemulsification and ECCE, reported the mean surgically induced astigmatism to be 0.91D and 1.36D in the phacoemulsification and extracapsular cataract extraction group. And concluded that phacoemulsification improves the surgical control of refractive outcome of cataract surgery.[10] Similarly in another study by Watson A and Sunderraj P has reported that less astigmatism was induced by phacoemulsification than extracapsular surgery, measured at all post-operative time intervals.[6]

The results of this study shows that there is no significant difference in amount of astigmatism between both groups receiving the corneal and scleral incision throughout the study period with both showing 1.25D of mean astigmatism at the end of follow up. Similar results have been reported by the different researchers; Poort-van Nouhuijs HM, Hendrickx KH reported no significant difference in patients receiving scleral tunnel

Table-3: Best corrected post operative visual acuity (Final Evaluation)

Visual Acuity	No. Of Patients
6/6-6/9	40 (91.0%)
6/12-6/18	2 (4.5%)
6/24-6/60	2 (4.5%)
Total	44

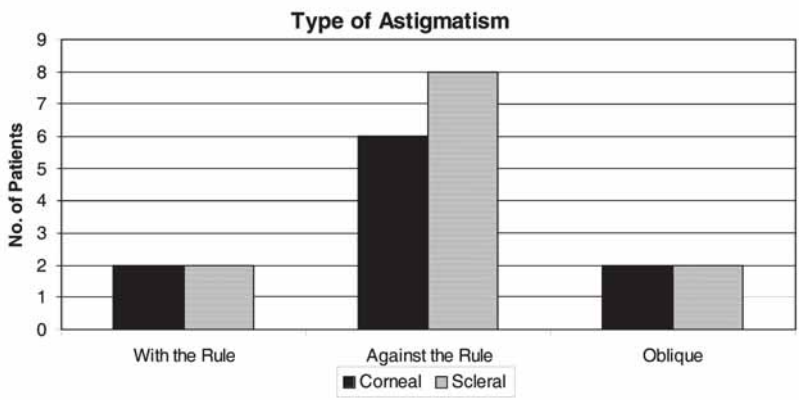

Fig. 3. Type of astigmatism

incision and clear corneal incision.[11] Similarly Gross RH, Miller KM found astigmatism to be of same amount in both group after 6 weeks.[12]

The change in Keratometry reading in both group showed insignificant change in corneal curvature. Similarly topographic studies following cataract surgery by phacoemulsification has demonstrated that a smaller wound in phacoemulsification surgery produces minimal change in corneal curvature.[13] This consolidates the result of minimum change in astigmatism due to the phacoemulsification surgery.

Patients were willing to undergo surgery only when available vision was hindering their day to day activities. Most of the patients undergoing phacoemulsification surgery achieved normal visual acuity with majority having only a small postoperative astigmatism. Phacoemulsification surgery hence ensures a normal visual recovery with insignificant change in corneal curvature and a few patients require spectacles after surgery.

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